GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[X] ORIGINAL [ ] REVISION NO. _____

Project No. G-33-671 GTRI/~~GIT~~ DATE 8 / 24 / 84

Project Director: P. G. McDougal School/~~DEPT~~ Chemistry

Sponsor: American Chemical Society

Type Agreement: Grant In Aid PRF #15901 G1

Award Period: From 7/1/84 To ~~8/31/86~~ 8/31/87 (Performance) ~~8/31/86~~ 8/31/87 (Reports)

Sponsor Amount:	This Change	Total to Date
Estimated:	$ 15,000	$ 15,000
Funded:	$ 7,500	$ 7,500 (Est. thru 6/30/85)

Cost Sharing Amount: $ None Cost Sharing No: N/A

Title: Allylic Ethers as Chiral Building Blocks

ADMINISTRATIVE DATA OCA Contact Ralph Grede X4820

1) Sponsor Technical Contact:	2) Sponsor Admin/Contractual Matters:
Dr. Joseph E. Rogers, Jr.	Dr. Joseph E. Rogers, Jr.
The Petroleum Research Fund	The Petroleum Research Fund
American Chemical Society	American Chemical Society
1155 16th Street, NW	1155 16th Street, NW
Washington, DC 20036	Washington, DC 20036

Defense Priority Rating: None Military Security Classification: None

(or) Company/Industrial Proprietary: N/A

RESTRICTIONS

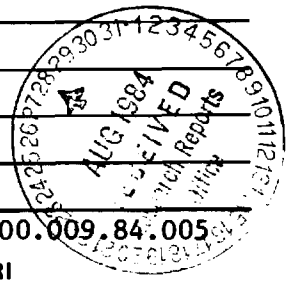
See Attached N/A Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval – Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with GIT

COMMENTS:

Two-year grant with two payments of $7,500 each.



Sponsor I.D. #02.500.009.84.005

COPIES TO:

Project Director (McDougal)
Research Administrative Network
Research Property Management
Accounting

Procurement/EES Supply Services
Research Security Services
Reports Coordinator (OCA)
Research Communications (2)

GTRI
Library
Project File
Other I. Newton

FORM OCA 4:383

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

N 28-181

Date November 4, 1987

Project No. G-33-671 School/~~kxx Chemical Engineering~~ Chemistry

Includes Subproject No.(s) N/A

Project Director(s) Dr. P. G. McDougal GTRC /~~XXX~~

Sponsor American Chemical Society

Title Allylic Ethers as Chiral Building Blocks

Effective Completion Date: 8/31/87 (Performance) 8/31/87 (Reports)

Grant/Contract Closeout Actions Remaining:

- [ ] None
- [x] Final Invoice or Final Fiscal Report
- [ ] Closing Documents
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other _____

Continues Project No. _____ Continued by Project No. _____

COPIES TO:

Project Director
Research Administrative Network
Research Property Management
Accounting
Procurement/GTRI Supply Services
Research Security Services
Reports Coordinator (OCA) ✓
Legal Services

Library
GTRC
Research Communications (2)
Project File
Other Russ Embry
Angela DuBose
Duane Hutchison

FORM OCA 69.285

PERSONNEL STATEMENT

PRF# 11590-G1 REPORTING PERIOD 7/1/84 TO 6/30/85

GRANTEE INSTITUTION Georgia Institute of Technology DEPARTMENT

PRINCIPAL INVESTIGATOR(S) Patrick G. McDougal

GRANT PROJECT TITLE Allylic Ethers as Chiral Building Blocks (Old)
Heteroatom Assisted Deprotonation in Acyclic Systems (New)

List undergraduate, graduate, and postdoctoral co-workers receiving stipends under the above named grant:

NAME	TITLE OR ACADEMIC APPOINTMENT	PREVIOUS EDUCATION & DEGREES*	COUNTRY OF PERMANENT RESIDENCE	PERIOD OF SUPPORT (MONTHS)	PERCENT OF SUPPORT FROM PRF **	DEGREES RECEIVED (IF ANY) DURING REPORTING PERIOD
Joseph G. Rico	Grad. Student	Vanderbilt (M.S.)	USA	3 months	100%	
Young-Im Oh	Grad. Student	Ewha Womans University	S. Korea	3 months	100%	

List other co-workers on grant project not directly supported with ACS - PRF funds:

NAME	SOURCE OF SUPPORT	DATES ASSOCIATED WITH GRANT PROJECT

* For graduate students, indicate the College or University attended prior to graduate work. For postdoctoral fellows, give the name of the Ph. D. granting institution.

** (during the period stated in preceding column)

G-33-671

School of Chemistry
(404) 894-4002

Georgia Institute of Technology
Atlanta, Georgia 30332
A Unit of the University System of Georgia

October 19, 1987

Petroleum Research Fund
American chemical Society
1155 Sixteenth Street, N.W.
Washington D.C. 20036

Dear Sir or Madam:

Please find enclosed a personnel statement for my PRF #15901-G1 grant. Our contracting office will be sending you a final financial statement. According to my records there is $70.90 left in the account. As I would like to terminate this grant, I have instructed our contracting office to return this money to PRF. No new results were forthcoming this reporting period and so I have not enclosed a research report. The work dicussed in last years report has resulted in two new publications. The second is scheduled to appear in the next issue of the Journal of Organic Chemistry and upon its appearance I will send you the two bibliographies.

This should terminate my grant. I appreciate the support of the PRF and am happy to report that the work initiated with this grant has recently recieved funding from the NSF.

Sincerely,

Patrick G. McDougal
Assistant Professor of Chemistry

XC: WELCH, HEITMULLER, FILE
(2 pgs)

PERSONNEL STATEMENT

PRF# 15901-G1 REPORTING PERIOD 9/1/86 TO 8/31/87

GRANTEE INSTITUTION Georgia Institute of Technology DEPARTMENT Chemistry

PRINCIPAL INVESTIGATOR(S) Patrick G. McDougal

GRANT PROJECT TITLE Heteroatom Assisted Deprotonations in Acyclic Systems

List undergraduate, graduate, and postdoctoral co-workers receiving stipends under the above named grant:

NAME	TITLE OR ACADEMIC APPOINTMENT	PREVIOUS EDUCATION & DEGREES*	COUNTRY OF PERMANENT RESIDENCE	PERIOD OF SUPPORT (MONTHS)	PERCENT OF SUPPORT FROM PRF **	DEGREES RECEIVED (IF ANY) DURING REPORTING PERIOD
Joseph Jump	Research Ass	B.S./ Purdue	USA	3 months	17%	None

List other co-workers on grant project not directly supported with ACS - PRF funds:

NAME	SOURCE OF SUPPORT	DATES ASSOCIATED WITH GRANT PROJECT

* For graduate students, indicate the College or University attended prior to graduate work. For postdoctoral fellows, give the name of the Ph. D. granting institution.

** (during the period stated in preceding column)

Revised 6/82

G-33-671

GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

Georgia Institute of Technology
Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

October 1, 1986

Del. Item # 3

The Petroleum Research Fund
American Chemical Society
1155 Sixteenth Street, N.W.
Washington, D. C. 20036

Gentlemen:

Enclosed in duplicate is the Annual Financial Statement for PRF No. 15901-G1 for the year ended August 31, 1986.

If you have questions or require any additional information, please contact this office at (404) 894-5523.

Sincerely,

Valeria D. Henderson, Accountant I
Grants & Contracts Accounting

VDH/djt

Enclosures

cc: Dr. P. G. McDougal/Chemistry, 0400
Dr. F. Joseph Schork/Chem Eng, 0100
Mr. Ralph Grady/OCA-PAD, 0420
File G-33-671 (R5791-0A0)

FINANCIAL STATEMENT

(Insert "ANNUAL" or "FINAL", as appropriate)

AMERICAN CHEMICAL SOCIETY - THE PETROLEUM RESEARCH FUND

For the Period: 9/1/85 to 8/31/86

(The preferred closing date for the reporting period is August 31)

Balance Carried Forward from Previous Reporting Period (from Same or Earlier Grant)		232.24
Received from PRF During This Reporting Period (Include Summer Research Supplements)		7,500.00
Stipends to:		
a. Principal Investigator . . . . . (Contribution Toward Summer Salary)*		
b. Undergraduate Students		
c. Graduate Students	109.74	
d. Postdoctoral Fellows		
e. Summer Research Fellows (Only if funded by Summer Research Supplement) Faculty ☐ Student ☐ (check one).		
f. Other (Specify)		
Tuition		
Materials and Supplies	5,666.64	
Equipment		
Computer Time Charges		
Travel (Explain if in excess of budget). . .		
Other Expenses (Attach itemized list) . . .		
Departmental Allocation*		
*If provided in grant agreement		
Total Expenditures During Reporting Period. .	5,776.38	
Balance on Hand at End of Period		1,955.86
Total of PRF Grant Payments Received to Date		15,000.00

Complete this section ONLY for a Financial Statement which shows a balance in the grant account at the termination date of the current grant agreement.

The balance in the grant account will be liquidated:

☐ By refund of unspent and uncommitted funds. The check should be drawn to the order of American Chemical Society - The Petroleum Research Fund, and identified by the PRF grant number.

☒ By use in the completion of the grant project. We hereby request approval by the American Chemical Society of an extension of the grant agreement, without commitment of additional funds, until 3/31/87 (Period up to one year, renewable).

We certify that the expenses reported herein were incurred for education and research in accord with the terms of the approved ACS-PRF grant-in-aid.

Georgia Tech Research Corporation
(Grantee Institution)

Valeria D. Henderson
Financial Officer (typed name)

(Signature)

(404) 894-5523
(Telephone)

October 1, 1986
(Date)

Patrick G. McDougal
Principal Investigator (typed name)

15901-G1
PRF Number

Please submit to the Petroleum Research Fund, American Chemical Society
1155 Sixteenth Street, N.W., Washington, D.C. 20036 Telephone (202) 872-4481

Rev. 6/85

ee Reverse Page
or Instructions

PRF # 15901-G1

FINAL FINANCIAL STATEMENT
(Insert "ANNUAL" or "FINAL", as appropriate)

AMERICAN CHEMICAL SOCIETY - THE PETROLEUM RESEARCH FUND

For the Period: 9/1/86 to 8/31/87
(The preferred closing date for the reporting period is August 31)

Balance Carried Forward from Last Reporting Period (for This or Previous Grant)		1,955.86
Total Payments Received from PRF During This Reporting Period (Include Summer Research Supplements)		—
Stipends to:		
a. Principal Investigator (Contribution Toward Summer Salary)*		
b. Undergraduate Students		
c. Graduate Students	477.60	
d. Postdoctoral Fellows		
e. Summer Research Fellows (Only if funded by Summer Research Supplement) Faculty ☐ Student ☐ (check one).		
f. Other (Specify)		
Tuition		
Materials and Supplies	1407.36	
Equipment		
Computer Time Charges		
Travel (Explain if in excess of budget. Identify costs for field work, if any)		
Other Expenses (Attach itemized list).		
Departmental Allocation*		
*If provided in grant agreement		
Total Expenditures During Reporting Period	1884.96	
Balance on Hand at End of Period		70.90

DO NOT complete this section unless there is a balance in the grant account at the termination date of the current grant agreement.

The balance in the grant account will be liquidated:

☒ By refund of unspent and uncommitted funds. The check should be drawn to the order of American Chemical Society-The Petroleum Research Fund, and identified by the PRF grant number.

☐ By use in the completion of the grant project. We hereby request approval by the American Chemical Society of an extension of the grant agreement, without commitment of additional funds, until _____ (Period up to one year, renewable).

This is to certify that the expenses reported herein were incurred for education and research in accord with the terms of the approved ACS-PRF grant-in-aid.

Georgia Institute of Technology
(Grantee Institution)

Patrick G. McDougal
Name of Principal Investigator

Financial Officer (typed name) (Signature) (Telephone) (Date)

Please submit to The Petroleum Research Fund, American Chemical Society
1155 Sixteenth Street, N.W., Washington, D.C. 20036 Telephone (202) 872-4481

Rev 3/87

G-33-671

THE PETROLEUM RESEARCH FUND

REPORT ON ACTIVITY ASSISTED BY

GRANT, PRF # 15901-G1

Page 1 of 1 pages.

PREPARED BY

Patrick G. McDougal

Date September 27, 1985

Please refer to instructions.

Fill in information requested above for each page.

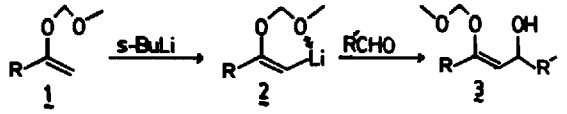
The report heading, narrative, and all drawings must be prepared within the box.

Please submit one sharp, clear "original" and a copy (Xerox, carbon, etc.) for each page.

901-G1 Heteroatom Assisted Deprotonations in Acyclic Systems

Patrick G. McDougal, Georgia Institute of Technology

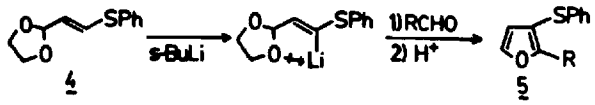
During the past year we have discovered a number of heteroatom assisted deprotonations in acyclic systems. The first of these involves the direct β-lithiation of an enol ether (1→2) which ultimate produced a variety of substituted enol ethers (3). While the preliminary studies concentrated on strenyl enol ethers (R=Ph)[1], we have recently extended this reaction to dienyl systems (R=vinyl)



1 2 3

with good success (R'=CH_3(52%), R'=Ph(55%). The chemistry of the resulting adducts 3, which are essentially enolized aldol adducts, is currently under investigation.

In a second system we have developed an efficient elaboration of aldehydes to 3-thiofurans. The key step in this sequence is the regioselective deprotonation of vinyl sulfide 4. The resulting anion is then reacted with an aldehyde and treated with acid to produce



4 5

the thiofuran 5 in yields of 56-70% (6 examples). Currently we are evaluating the potential of 3-thiofurns as activated dienes for the Diels-Alder reaction.

(1) McDougal, P.G.; Rico, J.G. Tetrahedron Lett. (1984), 25, 5977.
(2) McDougal, P.G.; Oh, Y.-I., submitted for publication.

G-33-671

THE PETROLEUM RESEARCH FUND

REPORT ON ACTIVITY ASSISTED BY

GRANT, PRF # 15901-G1

Page 1 of 1 pages.

PREPARED BY

Patrick G. McDougal

Date September 26, 1986

Please refer to instructions.

Fill in information requested above for each page.

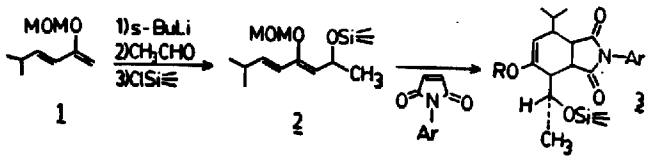
The report heading, narrative, and all drawings must be prepared within the box.

Please submit one sharp, clear "original" and a copy (Xerox, carbon, etc.) for each page.

15901-G1 Heteroatom Assisted Deprotonations in Acyclic Systems

Patrick G. McDougal, Georgia Institute of Technology

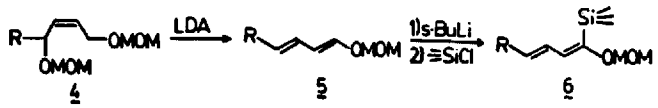
The direct β-lithiation of 2-alkoxydienes produces, upon reaction with aldehydes, a novel class of alkoxydienes (2) containing a chiral allylic carbon. We have discovered that these dienes react with complete π-face selectivity in the



1 2 3

Diels-Alder reaction with both N-phenylmaleimide and acrolein[1]. The relative stereochemistry was ascertained from an X-ray analysis of compound 3.

As the methoxymethyl(MOM) group seemed to direct β-lithiation, we have evaluated its efficacy in directing α-lithiation of polyvinyl ethers. Base catalyzed elimination of the olefinic



4 5 6

ether 4 (R= alkyl,vinyl) produces the desired substituted dienes 5 in good yield (60%-80%). In all cases the E,E-isomer predominates (>85%). These dienes are efficiently lithiated in the α-position without concomitant addition of the alkyllithium base to the dienyl system.[2]

(1) McDougal,P.G.; Rico,J.G.; Van Derveer,D. J. Org. Chem.(1986), 51, 0000.
(2) McDougal,P.G.; Rico,J.G., manuscript in preparation.